

What is Claimed is:

5 1. An ultrashort pulse generator for generating ultrashort optical pulses, comprising:
an ultrashort optical pulse source generating ultrashort optical pulses; and
a wavelength conversion channel for converting a wavelength of said ultrashort optical
pulses to a different wavelength, comprising an optical waveguide including an optical
parametric generation portion for parametrically generating said ultrashort optical pulses at said
different wavelength.

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9 2. The ultrashort pulse generator as claimed in claim 1, further including a mode
converter for coupling input light into said optical waveguide.

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11 3. The ultrashort pulse generator as claimed in claim 2, wherein said mode converter
comprises an adiabatically tapered waveguide.

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13 4. The ultrashort pulse generator as claimed in claim 2, wherein said mode converter
comprises a second harmonic generator located within said optical waveguide.

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18 5. The ultrashort pulse generator according to claim 1, wherein said optical waveguide
is formed in a substrate comprising a periodically-poled ferroelectric optical material.

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21 6. The ultrashort pulse generator according to claim 5, wherein said periodically-poled
ferroelectric optical material is one of: lithium niobate, lithium tantalate, MgO:LiNbO_3 , KTP
22 and crystals of the KTP isomorph family.
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25 7. The ultrashort pulse generator according to claim 1, wherein said wavelength
26 conversion channel converts the wavelength of said ultrashort optical pulses as a function of at

27 least one of: a temperature of the wavelength conversion channel; a wavelength of light pumped
28 into said wavelength conversion channel; and a periodic-poling period of an electric field in said
29 wavelength conversion channel.

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31 A 8. The ultrashort pulse generator according to claim 1, wherein said ultrashort optical
32 pulse source is a mode-locked fiber laser.

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34 A 9. The ultrashort pulse generator according to claim 8, wherein said mode-locked fiber
35 laser is an erbium-doped fiber laser.

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37 A 10. The ultrashort pulse generator according to claim 1, wherein said ultrashort optical
38 pulse source is one of: a Ti:sapphire laser, a Cr:Forsterite laser, a Cr:LiSaF laser and a
39 Cr:LiSGaF laser.

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41 A 11. The ultrashort pulse generator according to claim 1, wherein said wavelength
42 conversion channel further comprises at least one harmonic generator for generating ultrashort
43 optical pulses whose wavelength is shorter than the wavelength of the ultrashort optical pulses
44 generated by said ultrashort optical pulse source.

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46 A+H 12. The ultrashort pulse generator according to claim 1, further comprising an ultrashort-
47 pulse amplifier upstream of said wavelength conversion channel for amplifying said ultrashort
48 optical pulses.

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50 A+H 13. The ultrashort pulse generator according to claim 12, wherein said ultrashort-pulse
51 amplifier is an erbium fiber amplifier.

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14. In combination:

a color image generating device; and

an ultrashort pulse generator for supplying image data to said color image generating device in the form of red, green and blue ultrashort optical pulses, said ultrashort pulse generator comprising: an ultrashort optical pulse source generating ultrashort optical pulses; a first wavelength conversion channel for converting a wavelength of said ultrashort optical pulses to produce red ultrashort optical pulses; a second wavelength conversion channel for converting the wavelength of said ultrashort optical pulses to produce blue ultrashort optical pulses; a third wavelength conversion channel for converting the wavelength of said ultrashort optical pulses to produce green ultrashort optical pulses.

15. The combination according to claim 14, wherein said first wavelength conversion channel includes an optical parametric generation portion which parametrically generates the red ultrashort optical pulses, said second wavelength conversion channel includes an optical parametric generation portion which parametrically generates the blue ultrashort optical pulses, and said third wavelength conversion channel includes an optical parametric generation portion which parametrically generates the green ultrashort optical pulses.

16. The combination according to claim 14, wherein each of said first, second and third wavelength conversion channels comprises a waveguide formed in a substrate comprising a periodically-poled ferroelectric optical material.

17. The combination according to claim 16, wherein said periodically-poled ferroelectric optical material is one of: lithium niobate, lithium tantalate, $\text{MgO}:\text{LiNbO}_3$, and KTP and crystals of the KTP isomorph family.

81 18. The combination according to claim 14, wherein said ultrashort optical pulse source
82 is a mode-locked laser.

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84 19. The combination according to claim 14, wherein said ultrashort optical pulse source
85 is one of: a Ti:sapphire laser, a Cr:Forsterite laser, a Cr:LiSaF laser and a Cr:LiSGaF laser.

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a 87 20. The ^{combination}~~ultrashort pulse generator~~ according to claim 14, wherein said ultrashort optical
88 pulse source is a mode-locked fiber laser. ✓

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a 90 21. The ^{combination}~~ultrashort pulse generator~~ according to claim ²⁰~~14~~, wherein said mode-locked fiber
91 laser is an erbium-doped fiber laser. ✓

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22. In combination:

a color image generating device; and

an ultrashort pulse generator for supplying image data to said color image generating device in the form of red, green and blue ultrashort optical pulses, said ultrashort pulse generator comprising: an ultrashort optical pulse source generating ultrashort optical pulses; an optical pump for generating pump pulses at a pump wavelength; and an optical waveguide for converting a wavelength of said ultrashort optical pulses to red, green and blue wavelengths, said optical waveguide including: a first harmonic generation section responsive to said ultrashort optical pulses, for generating harmonic ultrashort optical pulses at a harmonic wavelength; an optical parametric generation section responsive to the harmonic ultrashort optical pulses and the pump pulses, for parametrically generating signal ultrashort optical pulses at a signal wavelength and idler ultrashort optical pulses at an idler wavelength; a second harmonic generation section responsive to the signal ultrashort optical pulses, for generating the blue ultrashort optical pulses; and a third harmonic generation section responsive to said idler ultrashort optical pulses, for generating the red ultrashort optical pulses, said optical waveguide transmitting the green

108 ultrashort optical pulses at said pump wavelength.

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110 23. The combination according to claim 22, wherein said optical waveguide is formed in
111 a substrate comprising a periodically-poled ferroelectric optical material.

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113 24. The combination according to claim 23, wherein said periodically-poled ferroelectric
114 optical material is one of: lithium niobate, lithium tantalate, $\text{MgO}:\text{LiNbO}_3$, and KTP and crystals
115 of the KTP isomorph family.

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117 25. The combination according to claim 22, wherein said ultrashort optical pulse source
118 is a mode-locked laser.

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120 26. The combination according to claim 22, wherein said ultrashort optical pulse source
121 is one of: a Ti:sapphire laser, a Cr:Forsterite laser, a Cr:LiSaF laser and a Cr:LiSGaF laser.

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124 27. The ^{combination}~~ultrashort pulse generator~~ according to claim 22, wherein said ultrashort optical
pulse source is a mode-locked fiber laser. ✓

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28. The ^{combination}~~ultrashort pulse generator~~ according to claim 22, wherein said mode-locked fiber
laser is an erbium-doped fiber laser. ✓

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